SYSTEM FOR USE IN AN ASSEMBLY LINE

TECHNICAL FILED

[001] The present invention relates generally to a conveyor system for transporting items. More specifically, the present invention relates to a transfer system for rapidly transporting articles between non-synchronous elements of an assembly line.

BACKGROUND

[002] Conveyance systems for transporting articles through an assembly, processing or packaging line are common. These conveyance systems are typically comprised of a number of different elements each working in cooperation with the other to accomplish a particular task. For many such systems, every inline element must work synchronously with each other in order for the entire system to work properly.

[003] While these conveyance systems generally work for their intended purposes, the dependence of these systems on the synchronized performance of each element hinder their reliability, increase their cost, and make maintaining and updating these systems quite difficult. A break down in any inline element typically necessitates stopping the entire line while the broken element is repaired or replaced. Adding or replacing additional elements to a system will also typically require stopping the entire line, and in addition, will also typically require the resynchronization of the entire system. During these down periods, the entire line is shut and no products are produced.

[004] Current systems are also typically obtrusive structures that impart a large footprint on the factory floor. This is due in part to their many redundant elements and also largely due to the length of the conveyors which communicate with every element within a system. Floor space in a factory is usually limited, so minimizing the footprint of a conveyance system provides a significant benefit. Furthermore, reducing some of the redundancies of these systems will also typically reduce the cost of such systems.

packaged article is received, the cartoner places it into a carton and then seals the carton.

[011] The need for such intimate cooperation between the three systems is often inefficient and can increase the costs for producing a packaged article. Occasionally a cartoner or a transfer may need repair, or may need a refill of carton material, or may need to be replaced. During these periods, the degree of cooperation between the elements will typically require that the entire system be stopped until the repair or replacement is completed. This inefficiency can substantially limit the productivity of the line.

[012] Consequently, there is a need for a transfer system that is able to bridge between two elements such as the bagger and the cartoner and allow both elements to work independently of the other.

[013] There is also a need for a transfer system that can quickly and easily adjust to any increase or decrease in the number of articles it transports.

[014] There is also a further need for a transfer system that requires a minimum amount of floor space.

[015] Furthermore, a transfer system is needed that eliminates unnecessary redundant elements and that can be produced at a lower cost than similar systems.

BRIEF SUMMARY OF THE INVENTION

[016] The subject invention is a high speed transfer system capable of transferring articles between two nonsynchronized elements, enabling both elements to work largely independent of the other. One embodiment of the transfer system is generally comprised of an air conveyor, a servo conveyor, and a fan feeder. In a typical configuration, the air conveyor is located at a first location where it receives packaged articles from a bagger system or a conveyor system. The servo conveyor abuts the air conveyor and extends to a second location adjacent to a destination point. The fan feeder is located adjacent to the servo conveyor at an end opposite the air conveyor. The fan feeder lies directly

stopped by the fan feeder, and the packaged article is then guided into a bucket and conveyed to a cartoner.

BRIEF DESCRIPTION OF THE DRAWINGS

[022] FIG. 1 is a schematic view of a prior art conveyor system for cereal packages.

[023] FIG. 2 is a flow diagram of one embodiment of a conveyance system.

[024] FIG. 3a is a flow diagram displaying the subject transfer system.

[025] FIG. 3b is a front view of an embodiment of the subject transfer system.

[026] FIG. 4a is a flow diagram displaying the subject transfer system.

[027] FIG. 4b is an overhead view of the system of FIG. 3 integrated with parts of a bagger system and a cartoner system.

[028] FIG. 5 is an enlarge front view of a air conveyor from the system of FIG. 3.

[029] FIG. 6 is an enlarged overhead view of the air conveyor from the system of FIG. 3.

[030] FIG. 7 is an enlarged front view of a servo conveyor from the system of FIG. 3.

[031] FIG. 8 is an enlarged overhead view of the servo conveyor from the system of FIG. 3 (with belt removed).

[032] FIG. 9 is an enlarged front view of a fan feeder from the system of FIG. 3.

[033] FIG. 10 is an enlarged side view of the fan feeder from the system of FIG. 3.

[034] FIG. 11 is a flow diagram of an alternative configuration of the subject transfer system.

DETAILED DESCRIPTION

General Overview

[040] A packaged article is first received by the air conveyor 11 where it accumulates until transferred to the servo conveyor 12. As a bucket 20 approaches the fan feeder, the speed of the servo conveyor is adjusted automatically by a controller 26 so that a packaged article will be available to the fan feeder for placement within the bucket 20. The packaged article is transported by the servo conveyor 12 at a speed that will cause it to arrive at the fan feeder simultaneously with the bucket.

[041] Once at the feeder, the momentum of the packaged article carries it off the servo conveyor and into the fan feeder. The forward momentum of the packaged article is stopped by the fan feeder and the packaged article is then guided into a bucket and conveyed to a cartoner.

Air Conveyor

[042] As shown in Figs. 3a, 3b, and 4 , in one embodiment, the air conveyor 11 abuts a bagger system 9 and receives packaged articles therefrom. Preferably, each individual bagger deposits packaged articles directly onto a separate conveyor 18 that then delivers the packaged articles to the air conveyor 11. However, the air conveyor 11 may also be adapted to receive packaged articles directly from each individual bagger. The air conveyor 11 then transports the packaged articles to a location adjacent to the servo conveyor 12 and holds them until the servo conveyor 12 is prepared to receive it.

[043] A plurality of air conveyors 11 may be utilized to define a pathway between the conveyor system 18 and the servo conveyor 12. This eliminates the need to elongate the bucket conveyor so that it is adjacent to the baggers. Typically, the air conveyor will span territory at a significantly lower cost than an elongated bucket conveyor. Also, due to the reduction of moving parts, a shorter bucket conveyor is typically more reliable than an elongated one.

[044] Figs. 5 and 6 show an air conveyor. As shown in Figs. 5 and 6, in one embodiment, the air conveyor includes a frame 15 having longitudinal upper 17 and lower 19 portions. The upper portion 17 supports a plenum 21 which is disposed longitudinally across the upper portion 17. The lower portion 19 supports an air source 23 which communicates with the plenum 21. A pair of

Servo conveyor

[050] As shown in Figs. 3a, 3b, and 4, in one embodiment, the servo conveyor 12 abuts the air conveyor 11 and receives packaged articles therefrom. The servo conveyor 12 works synchronously with the fan feeder 13 and the bucket conveyor 16 so that packaged articles are delivered at an interval which is compatible with the bucket conveyor 16. Synchronization is achieved through a controller 26 which monitors the position of a packaged article on the air conveyor 11 and the servo conveyor 12 relative to a bucket approaching the fan feeder 13. The controller 26 uses these input to determine an appropriate speed for the servo conveyor and when to activate the fan feeder.

[051] Figs. 7 and 8 show one embodiment of a servo conveyor. As shown in Figs. 7 and 8, in one embodiment, the servo conveyor 12 includes three separate conveyor mechanisms 39. Each of the conveyor mechanisms 39 work independent of the other, allowing all three conveyor mechanisms to operate at different speeds. Preferably, the conveyor mechanism 39 closest to the air conveyor 11 will operate at a slower speed than the other conveyor mechanisms 39, and the one adjacent to the fan feeder 13 will operate at the fastest rate. The progressive increase in speed between the conveyor mechanisms 39 separate the packaged articles so that generally only one packaged article is located on each conveyor mechanism. A number of optical detectors 40 are positioned along the servo conveyor 12 for detecting the position of a packaged article.

[052] The conveyor mechanism 39 can be one that is known in the art. A typical conveyor mechanism will include a belt 41, a plurality of rollers 42 to support and to apply tension to the belt 41, and a belt drive mechanism. In one embodiment, the belt drive mechanism includes a belt drive motor 43 coupled to a drive roller 45. Other belt drives known in the art and capable of generating the desired belt speeds can also be used.

Fan Feeder

[053] As shown in Figs. 3 and 4b, in one embodiment, the fan feeder 13 is located adjacent to the servo conveyor 12 at an end opposite the air conveyor

[058] The encoder 32 provides the controller an exact position of a particular bucket. An encoder typically monitors the rotation of a drive shaft or a gear wheel on the bucket converor in order to determine the position of a bucket. There are a number of encoders known in the art which may be used interchangeably with the subject invention. Many will use an optical sensing means to determine rotation of a drive shaft or gear wheel.

[059] The optical sensors 24, 40 determine the position of a packaged article with respect to the feeder, and the encoder 32 determines the position of a bucket on the bucket conveyor. With this information, the controller is able to adjust the speeds for each conveyor mechanism 39 to ensure that the packaged article will arrive at the fan feeder simultaneously with the bucket.

[060] The controller 26 also includes software to calculate the position of the packaged article, to control and adjust the servo conveyor, and to control the fan feeder. This software is typically dependent on the servo conveyor 12, the fan feeder 13, and on the application, and such software can be generally created by one skilled in the art without any undue experimentation. There are also a number of software programs known in the art that are adaptable to perform the requisite calculations and which can control the servo conveyor and the fan feeder. One such software package is included with the Delta Systems Flow Feeding System™.

Operation

[061] The subject transfer system 10 is able to receive packaged articles from the bagger system 9 in a nonsynchronized manner and place them within individual buckets 20 of a bucket conveyor 16 for a cartoner system. In so doing, the transfer system 10, enables the bagger system 9 to operate independently of the cartoner system.

[062] As shown in Fig. 4b , in one embodiment, the air conveyor 11 abuts a conveyor 18 from a bagger system 9 and receives packaged articles therefrom. The air conveyor 11 then transports the packaged articles to the servo conveyor 12 and holds them until the servo conveyor 12 is prepared to receive it.

cartoner). Once a deficient packaged article was found, the entire package was thrown away. As a result, a carton was wasted with each deficient packaged article. However, in many instances, the cost of a carton was greater than the cost of the packaged article, and so there was a significant loss with each deficient packaged article.

[068] Utilizing the subject invention, a faulty packaged article can be removed without affecting the cartoner system. Weighing scales 28 and metal detectors 30 can both be incorporated inline prior to the cartoner system. As such, if a packaged article fails a weight or metal test, it can be removed before being put in a carton. Depending on the number of faulty packaged articles produced, this ancillary benefit produces a significant savings.

[069] As shown in Fig. 11, another ancillary benefit to the subject invention is the general ease with which particular baggers may be switched to different cartoners, and vice versa. This is especially useful because a cartoner will typically work with only one size of carton. In order to add flexibility to a line, a number of transfer systems can be coupled to different cartoners, and the conveyor 18 can simply direct a flow of packaged articles into a transfer system for the intended cartoner. The conveyor 18 can also be configured so that it may selectively choose particular cartoners to receive packaged articles from.

[070] While the present invention has been described with reference to several embodiments thereof, those skilled in the art will recognize various changes that may be made without departing from the spirit and the scope of the claimed invention. Accordingly, this invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

a servo conveyor in cooperation with the air conveyor;

a feeder in cooperation with the servo conveyor;

a conveyor in cooperation with the feeder; and

a controller in communication with the servo conveyor and the feeder.

10. The transfer system of claim 9, and further comprising a plurality of sensors in communication with the controller and located on the air conveyor and servo conveyor to track movement of articles thereon, and wherein the controller adjusts the operation of the servo conveyor and the feeder in response to the position of the article.

11. The transfer system of claim 9, wherein the conveyor is a bucket conveyor having a plurality of buckets, and wherein the controller adjusts the operation of the servo conveyor and the feeder in response to the position of a particular bucket relative to the feeder.

12. The transfer system of claim 9, and further comprising a bagger system in cooperation with the air conveyor.

13. The system of claim 9, wherein the servo conveyor is comprised of multiple independent conveyor sections, each being separately controlled by the controller.

14. The system of claim 9, wherein the feeder includes a rotor having a blade to receive an article, and wherein rotation of the rotor is controlled by the controller.

21. The method of claim 20, wherein the second conveyor system includes a bucket conveyor, and wherein the first position is a bucket on the bucket conveyor.

22. The method of claim 21, wherein the step of adjusting the speed of first conveyor system includes the step of adjusting the speed of the servo conveyor.

23. A transfer system for packaged articles comprising:

a bagger system;

an air conveyor in cooperation with the bagger system;

a servo conveyor in cooperation with the air conveyor;

a feeder in cooperation with the servo conveyor;

a cartoner system in cooperation with the feeder; and

a controller in communication with the servo conveyor, the feeder, and the cartoner system.

24. The system of claim 23, wherein the cartoner system includes a bucket conveyor, and further comprising means for determining position of a bucket in the bucket conveyor relative to the feeder.

25. The system of claim 23, and further comprising means for determining position of an item on the transfer system.

26. The system of claim 23, and further comprising a cartoner system in cooperation with the bucket conveyor.

a transfer system in cooperation with the conveyor and the cartoner system, the transfer system self adjusting to support asynchronous operation of the bagger system and the cartoner system.

33. A conveyance system comprising a bagger system, a cartoner system, and a transfer system, wherein operation of the bagger system is uncoupled to operation of the cartoner system.

ABSTRACT

[071] A transfer system comprised of an air conveyor, a servo conveyor, and a fan feeder. In a typical configuration, the air conveyor is located at a first location where it receives packaged articles from a bagger system or a conveyor system. The servo conveyor abuts the air conveyor and extends to a second location adjacent to a destination point. The fan feeder is located adjacent to the servo conveyor at an end opposite the air conveyor. The fan feeder lies over a bucket conveyor for a cartoner system.

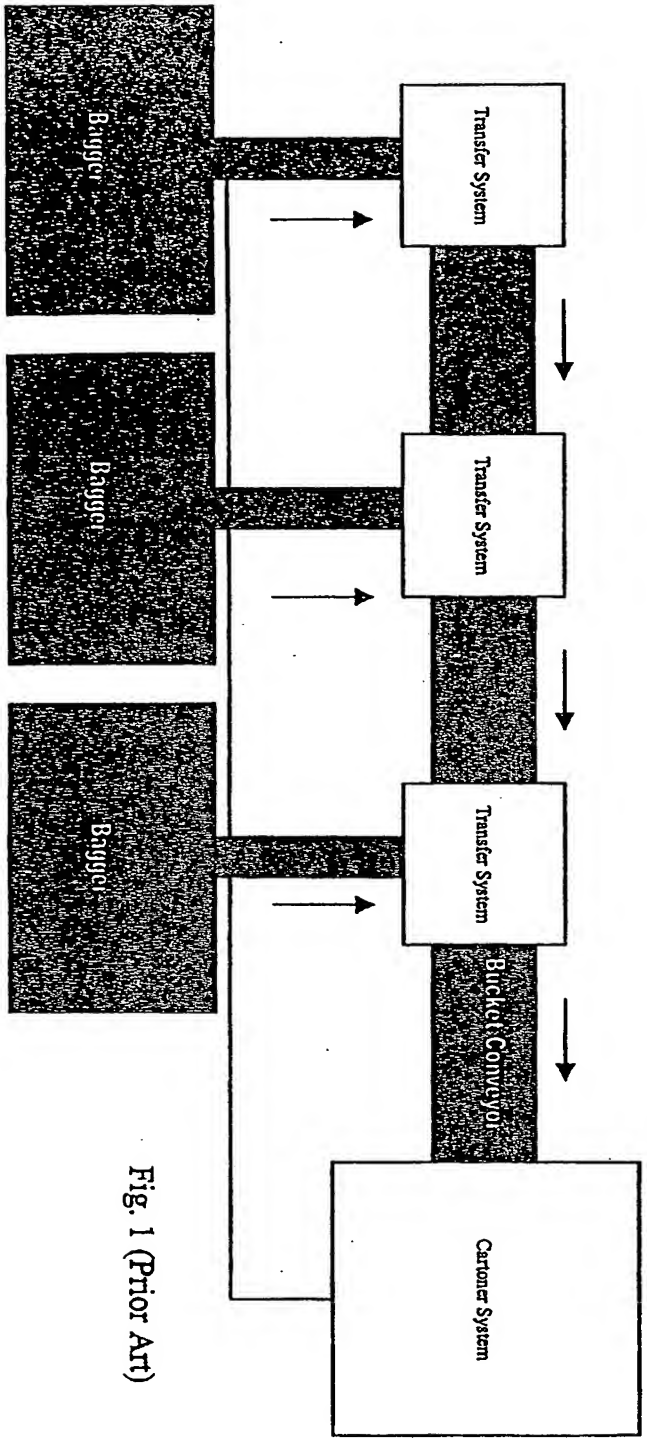

Fig. 1 (Prior Art)

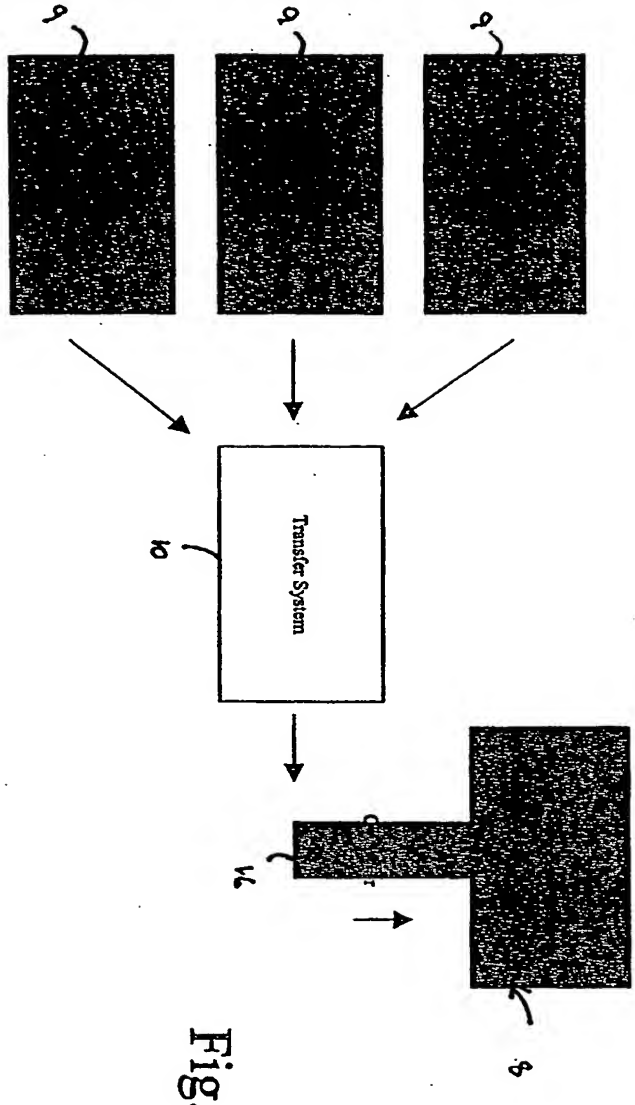

Fig. 2

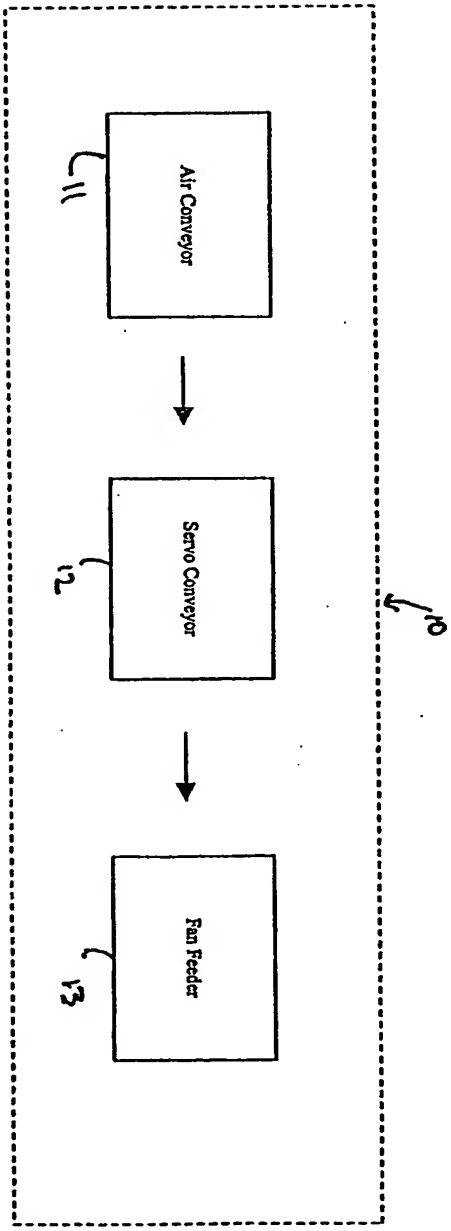

Fig. 3a

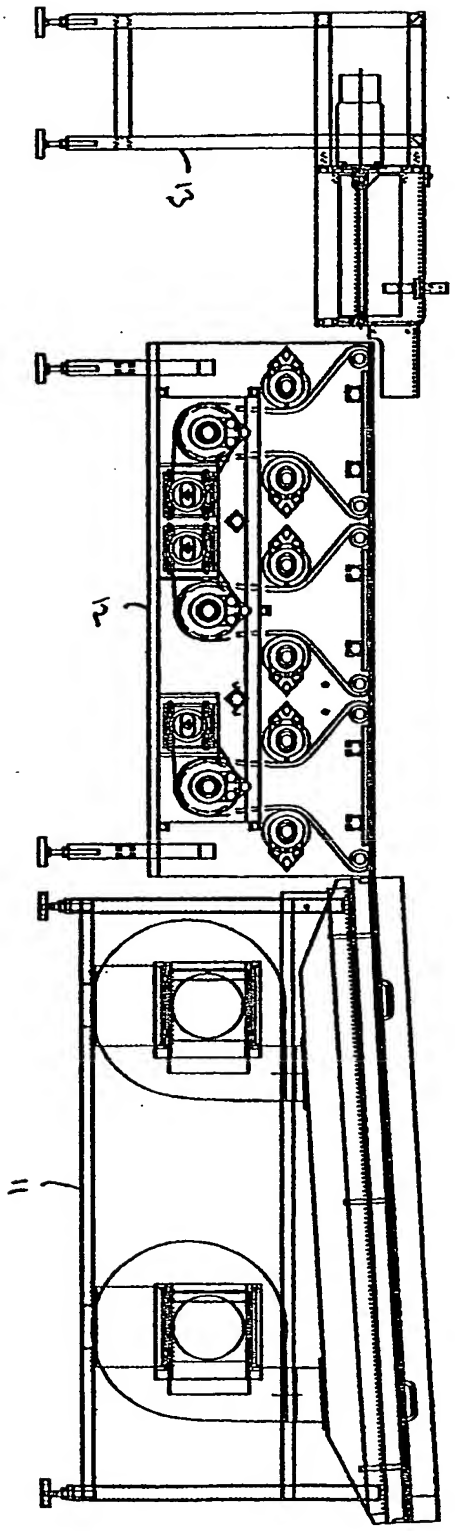

Fig. 3b

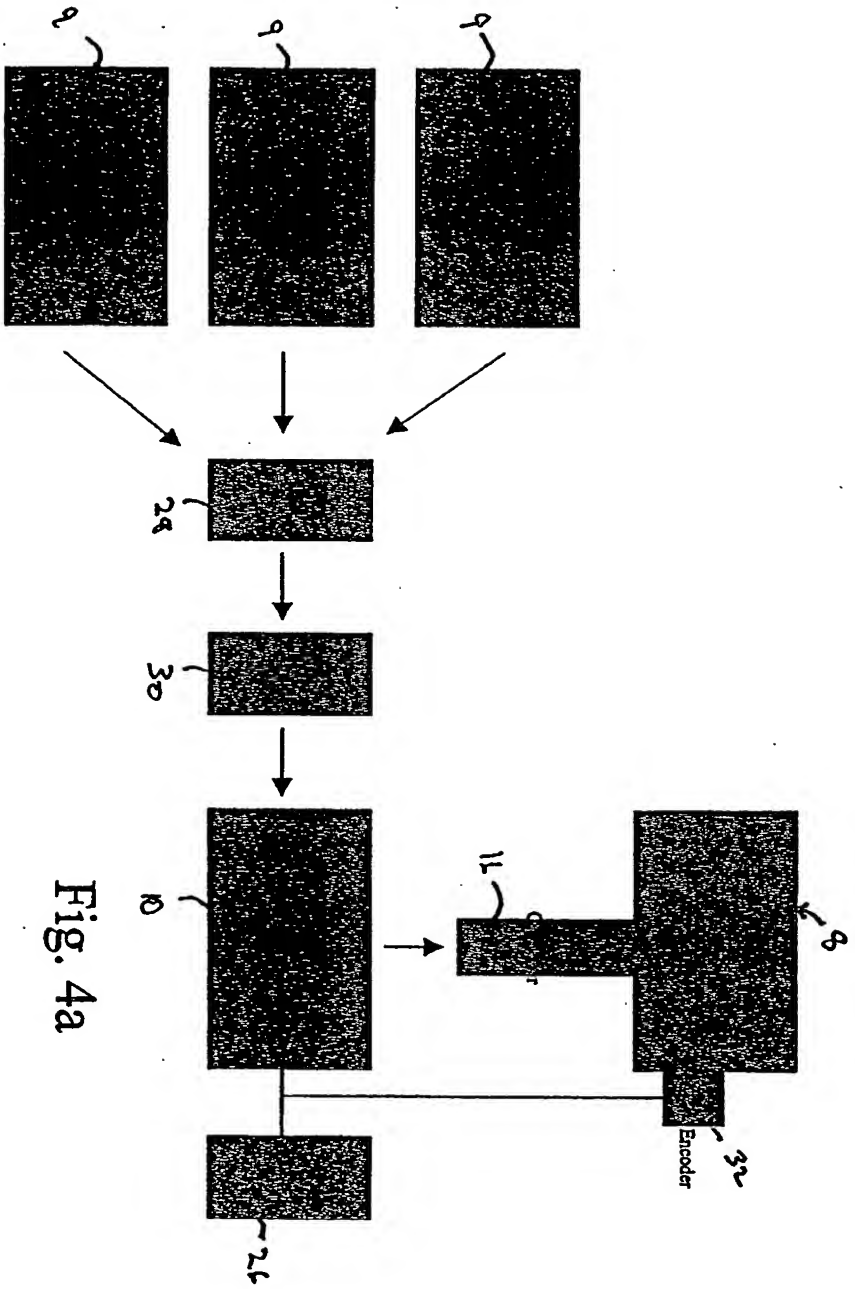

Fig. 4a

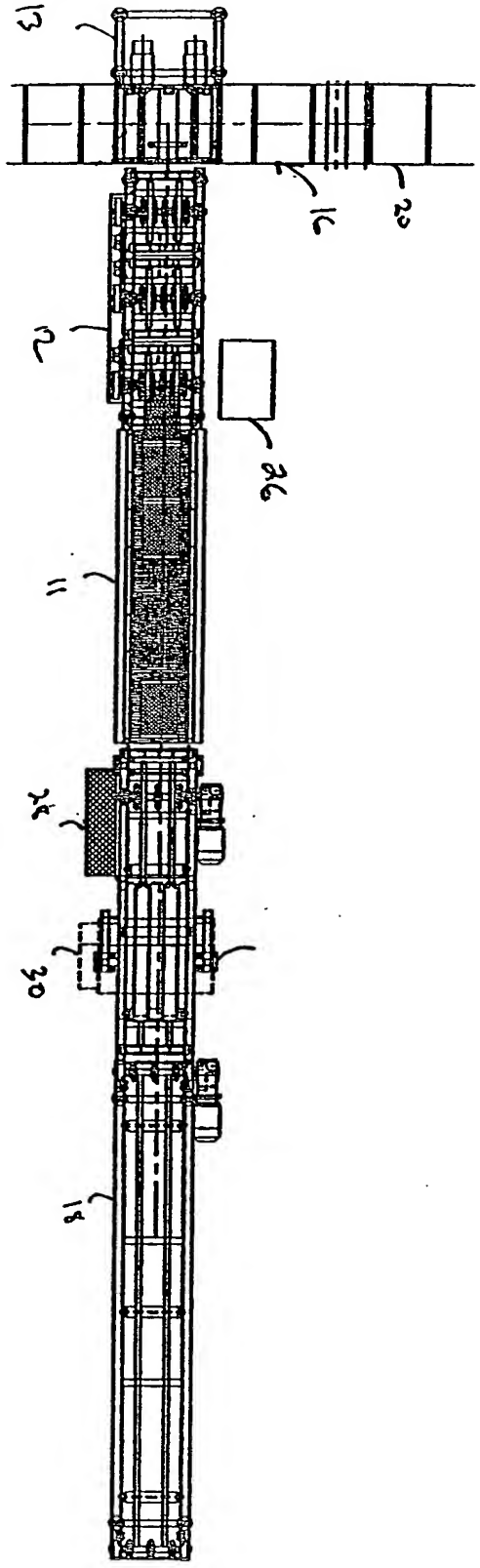

Fig. 4b

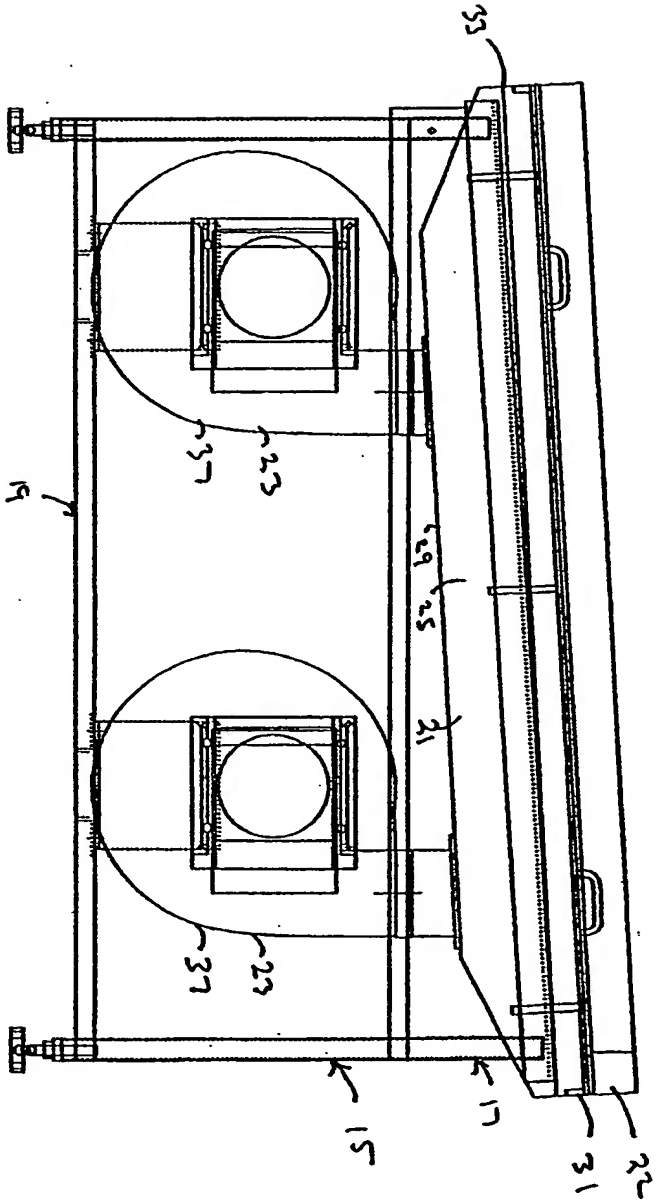

Fig. 5

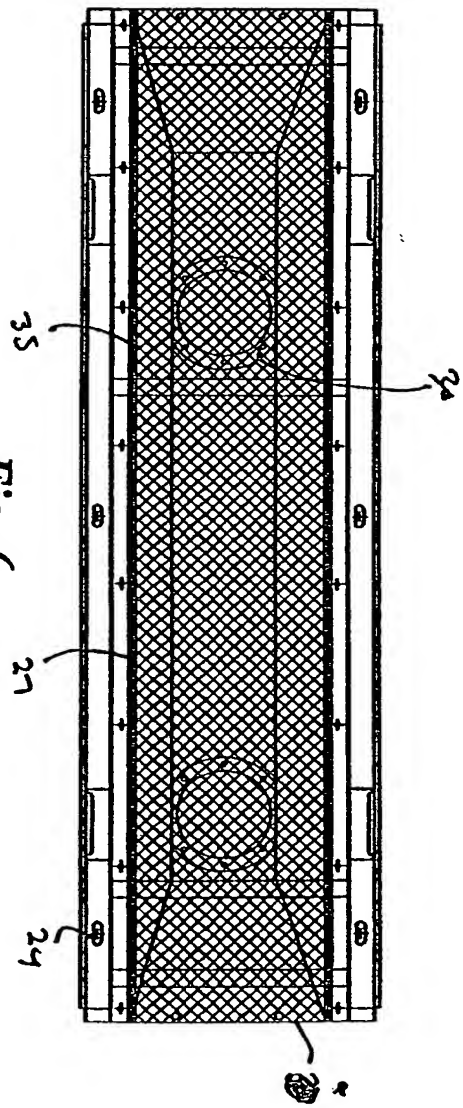

Fig. 6

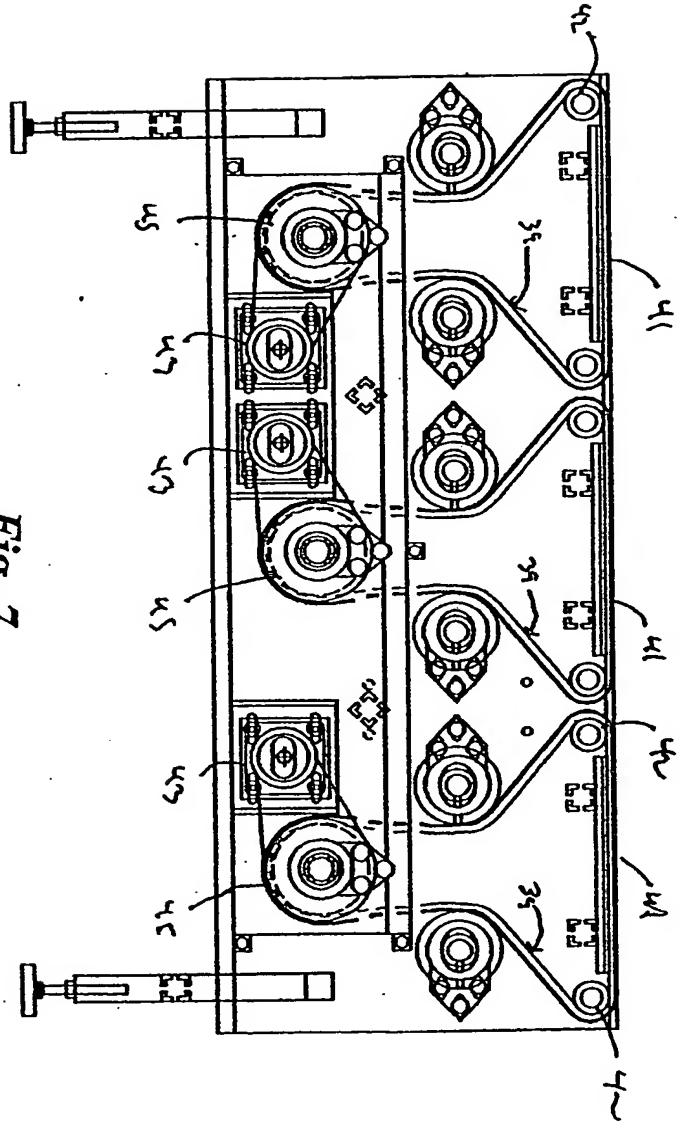

Fig. 7

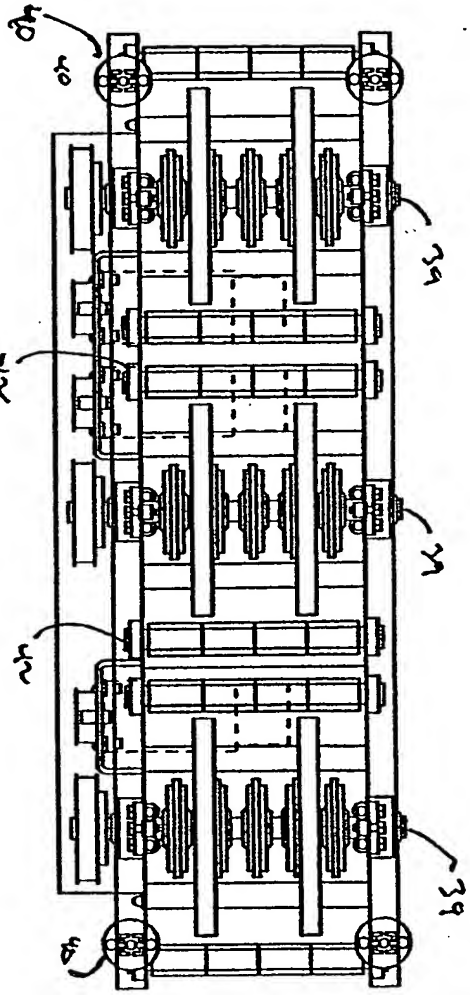

Fig. 8

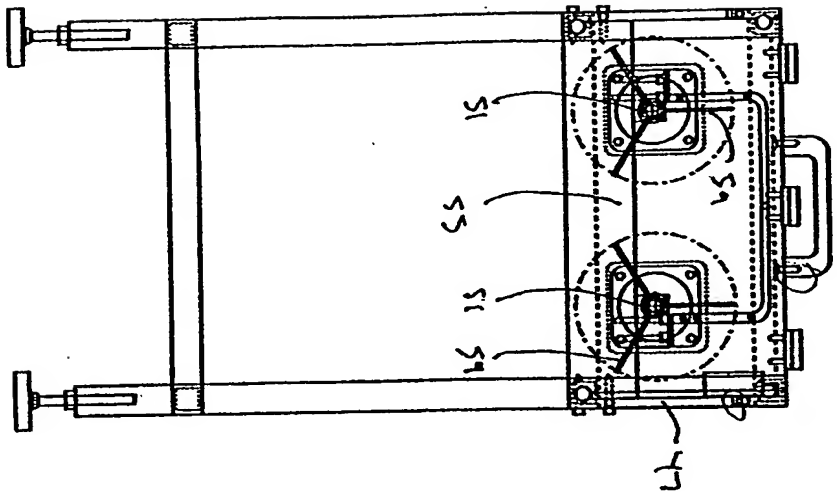

Fig. 9

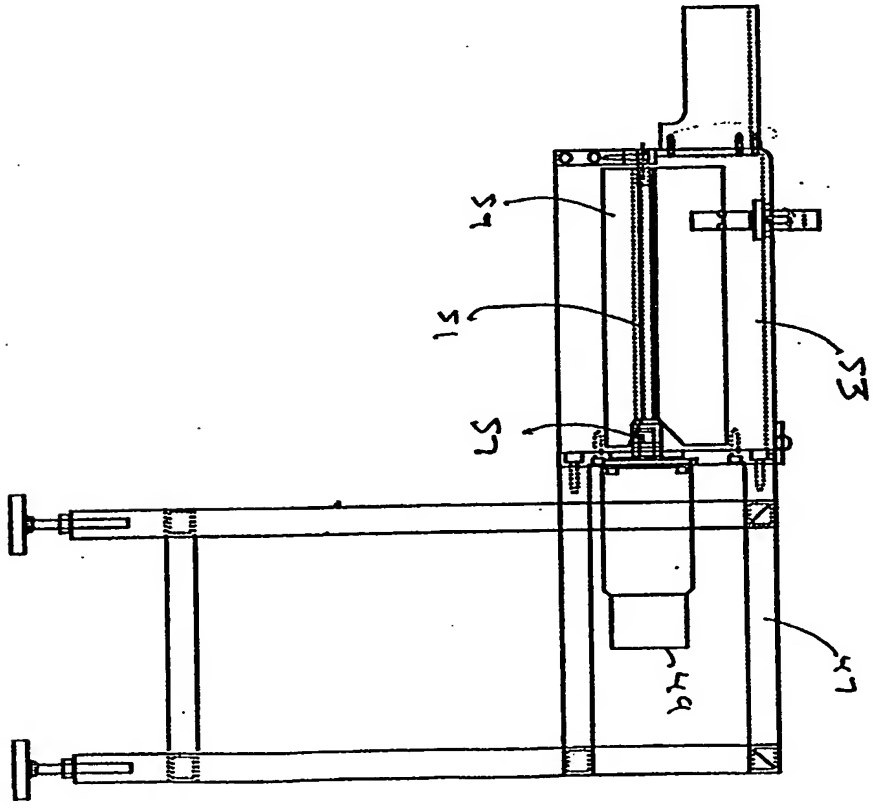

Fig. 10

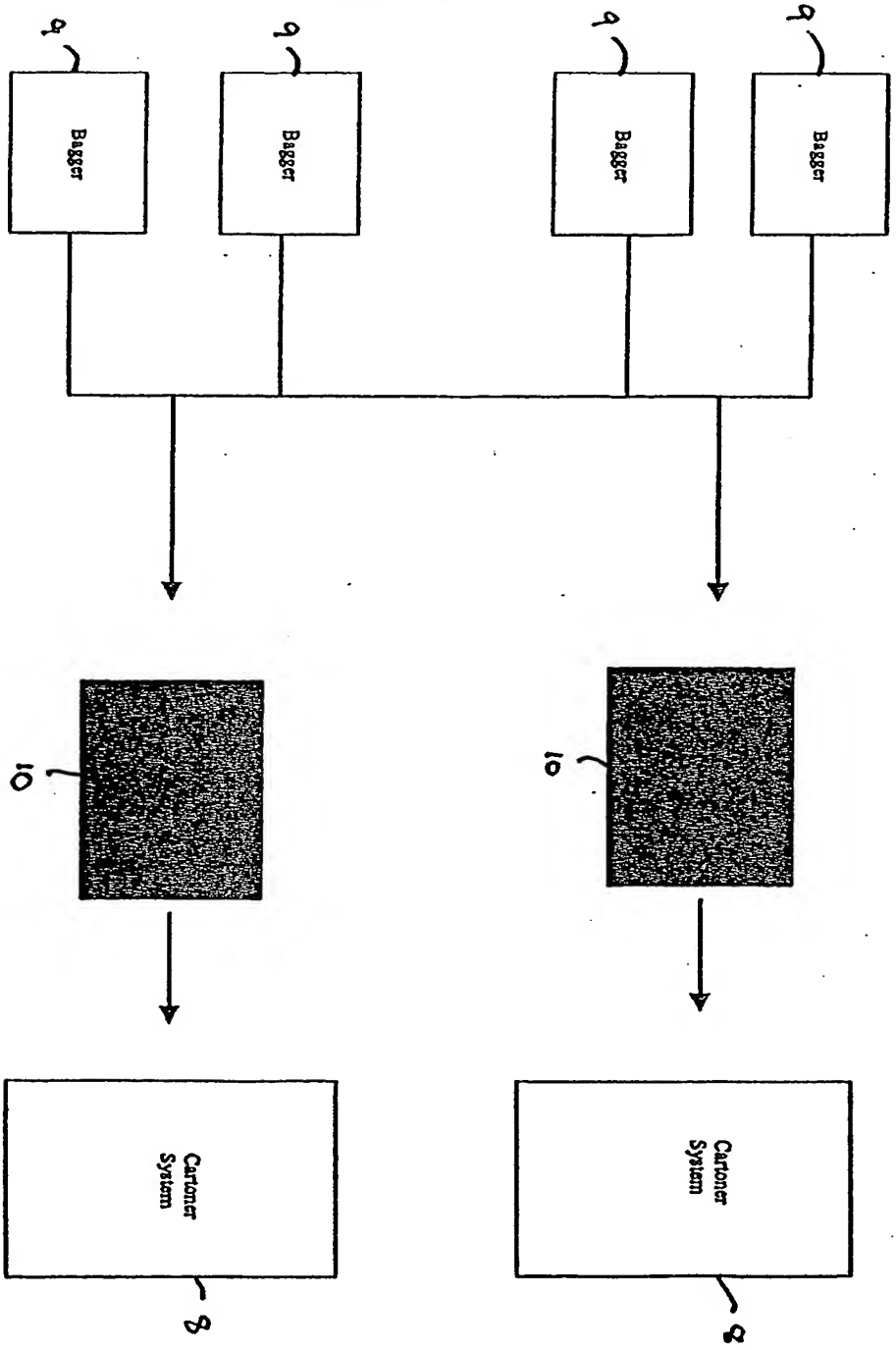
9
Bagger
9
Bagger
9
Bagger
9
Bagger
10
10
Cartoner System
Cartoner System
8
8

Fig. 11